

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions and listings of claims in the application. Applicant has amended Claim 1 in the following, in which added text is underlined and deleted text is stricken through or in double brackets. Applicant has added new Claim 15.

1. (Currently Amended) A method of determining a distance between objects, [[,]] the method comprising:

transmitting, from a transmitter, an ultrasonic signal having a specific frequency component maintained for a predetermined period;

receiving the ultrasonic signal[[,]] at a receiver ~~distanced~~ located at a distance from the transmitter, ~~the ultrasonic signal~~;

amplifying the received ultrasonic signal to generate an amplified signal;

filtering the amplified signal to generate a filtered signal in which an unnecessary frequency component of the amplified signal is removed or weakened;

converting the filtered signal into a digital signal;

extracting a portion of the converted digital signal that reflects the specific frequency component maintained for the predetermined period;

analyzing the extracted portion to determine an arrival time of the ultrasonic signal, ~~using the frequency component~~; and

determining [[a]] the distance between the transmitter and the receiver, using the arrival time.

2. (Cancelled)

3. (Cancelled)

4. (Cancelled)

5. (Previously presented) The method as claimed in claim 1, wherein the receiver is moving when receiving the ultrasonic signal.

6. (Previously presented) A method of determining a distance between objects, the method comprising:

transmitting, from a transmitter, an ultrasonic signal having a specific frequency component maintained for a predetermined period;

receiving the ultrasonic signal by a first receiver at a known distance from the transmitter;

determining a first arrival time of the ultrasonic signal at the first receiver;

receiving the ultrasonic signal by a second receiver at an unknown distance from the transmitter;

determining a second arrival time of the ultrasonic signal at the second receiver;

determining a speed of propagation of the ultrasonic signal using the first arrival time and the known distance; and

determining the unknown distance between the transmitter and the second receiver, using the second arrival time and the speed of propagation of the ultrasonic signal,

wherein determining the first arrival time of the ultrasonic signal received by the first receiver comprises:

amplifying the received ultrasonic signal to generate an amplified signal;

filtering the amplified signal to generate a filtered signal in which an unnecessary frequency of the amplified signal is removed or weakened;

converting the filtered signal into a digital signal;

extracting a portion of the converted digital signal, the extracted portion reflecting the specific frequency component maintained for the predetermined period; and

analyzing the extracted portion to determine the first arrival time.

7. (Previously presented) A device for determining a distance using an ultrasonic signal, the device comprising:

a transmitter configured to generate and transmit an ultrasonic signal having a specific frequency component maintained for a predetermined period;

a sensor distanced from the transmitter and configured to receive the ultrasonic signal transmitted from the transmitter;

an amplifier configured to amplify the ultrasonic signal received by the sensor;

an analog filter configured to select the specific frequency component from the ultrasonic signal amplified by the amplifier, thereby generating an analog-filtered signal;

an A/D converter configured to convert the analog-filtered signal to a digital data;
a memory configured to store the digital data therein; and

a digital signal processor configured to process the digital data stored in the memory to extract a portion reflecting the specific frequency component maintained for the predetermined period,

wherein the digital signal processor is further configured to analyze the extracted portion to determine an arrival time of the ultrasonic signal, and

wherein the digital signal processor is further configured to determine a distance between the transmitter and the sensor, using the arrival time.

8. (Previously presented) The device as claimed in claim 7, further comprising:

an output unit configured to display results processed in the digital signal processor;

a numerical input unit configured to inform the digital signal processor of a processing condition; and

a communication unit configured to connect the digital signal processor and an external apparatus so that the digital signal processor and the external apparatus exchange information.

9. (Cancelled)

10. (Previously presented) The method as claims in claim 1, further comprising amplifying the filtered signal again to generate a re-amplified signal, wherein converting the filtered signal into a digital signal comprises converting the re-amplified signal into a digital signal.

11. (Previously presented) The method as claims in claim 1, wherein extracting the portion of the converted digital signal comprises performing a convolution operation on the converted digital signal.

12. (Previously presented) The method as claimed in claim 1, wherein analyzing the extracted portion comprises determining a starting time of the extracted portion, and wherein the starting time is indicative of the arrival time of the ultrasonic signal.

13. (Previously presented) The method as claimed in claim 1, wherein determining the distance comprises:

determining a duration between the arrival time and a transmission time, wherein the transmission time is when the ultrasonic signal is transmitted from the transmitter; and

multiplying the duration with a speed of the ultrasonic signal.

14. (Previously presented) The method as claimed in claim 1, wherein the specific frequency component comprises a predetermined waveform repeated in a predetermined number within the extended period of time.

15. (New) A method of determining a distance between objects, the method comprising:

transmitting, from a transmitter, an ultrasonic signal having a specific frequency component maintained for a predetermined period;

receiving the ultrasonic signal at a receiver located at a distance from the transmitter;

processing the received signal to locate a signal portion representing a span of the specific frequency for the predetermined period;

analyzing the signal portion to determine an arrival time of the ultrasonic signal; and

determining the distance between the transmitter and the receiver, using the arrival time.